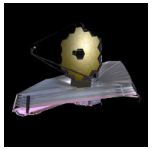

1897 - Measuring the Insoluble Organic Matter (IOM) and Polycyclic Aromatic Hydrocarbon (PAH) Content of Comet 9P/Tempel 1

Cycle: 1, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
NIRSPEC				
	1	NIRSPEC IFU	NIRSpec IFU Spectroscopy	(1) 81P
	2	NIRSPEC IFU Background	NIRSpec IFU Spectroscopy	(2) 81P-BACKGROUND
MIRI IFU				

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
	3	MIRI IFUs	MIRI Medium Resolution Spectroscopy	(1) 81P
	4	MIRI IFU Backgrounds	MIRI Medium Resolution Spectroscopy	(2) 81P-BACKGROUND

ABSTRACT

Comets are primitive remnants of solar system formation, cryogenically “preserved” in the outer solar system for the last 4.5 Gyr and retaining a record of the volatile and refractory material incorporated into their nuclei from the protosolar nebula. Systematically characterizing the composition of comets is necessary to understand the formation and evolution of the solar system, the presence of life on Earth, and the development of other young planetary systems. This program will measure the insoluble organic matter (IOM) and polycyclic aromatic hydrocarbon (PAH) content of 9P in its inner coma, thereby providing clues to the heritage and potential processing of its refractory organics. This study can only be performed with JWST owing to its sensitivity to faint extended emission, its spectral resolving power, and complete spectral coverage of the near- and mid-infrared. Discerning the nature of cometary refractory organics will directly address the Planetary Science objective of NASA’s 2020-2024 Vision for Scientific Excellence: advance scientific knowledge of the origin and history of the solar system and the potential for life elsewhere. This JWST spectroscopic study addresses fundamental questions in our understanding of the refractory organics in cometary material and the formation of the solar system. It affords the first opportunity to sample the complete infrared spectrum of cometary refractory organics, and represents a chance to test the limits of the JWST discovery space that complements cometary missions' in situ and sample analyses, thereby improving our understanding of the origins and evolution of the solar system.

OBSERVING DESCRIPTION

The proposed work will generate spectral-spatial data cubes spanning 2.8 - 28 microns. These measurements will characterize the insoluble organic matter (IOM) and polycyclic aromatic hydrocarbon (PAH) content of comet 9P/Tempel 1 during its 2022 perihelion passage. NIRSPEC IFU (G395H/F290LP) will sample features from 3 - 3.5 um diagnostic of IOM and PAHs, while simultaneously constraining production of H2O and trace organics (C2H6, CH3OH, CH4) that emit at nearby wavelengths. MIRI IFU (all channels/sub-bands) will sample IOM bonds including carbonyl (C=O), carboxylic acid (COO-) and C=C skeletal modes and will serve as a powerful tracer of PAHs. A four-point dither was used with the extended source flag. Extended emission from the coma will fill the NIRSpec and MIRI IFU FOVs, requiring dedicated off-target background observations. TA will not be used for this extended, moving target. The JPL Horizons ephemerides are expected to be of high astrometric accuracy. Observations are constrained to windows within the JWST FoR for which 9P/Tempel 1 is within 2 au of the Sun to maintain sufficient comet brightness.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	81P	TYPE=COMET,Q=1.598035332134565,E=0.537253323062309,I=3.237105400043289,O=136.098149920559,W=41.78195141780046,T=22-FEB-2010:16:18:23,TTimeScale=TDB,EQUINOX=J2000,EPOCH=01-SEP-2010:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=-95.62288,A1=1.801267415285E-9,A2=2.259401232004E-10,A3=-8.444359153509E-10,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.		
Comments: Extended=YES				
(2)	81P-BACKGROUND	TYPE=COMET,Q=1.598035332134565,E=0.537253323062309,I=3.237105400043289,O=136.098149920559,W=41.78195141780046,T=22-FEB-2010:16:18:23,TTimeScale=TDB,EQUINOX=J2000,EPOCH=01-SEP-2010:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=-95.62288,A1=1.801267415285E-9,A2=2.259401232004E-10,A3=-8.444359153509E-10,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.	TYPE=POS_ANGLE,RAD=180,ANG=90,REF=SUN	
Comments: Extended=YES				

Observation

Proposal 1897, Observation 1: NIRSPEC IFU Mon Feb 27 21:02:03 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observations:[NIRSPEC IFU Background (Obs 2)]

Diagnostics

(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	81P	TYPE=COMET,Q=1.598035332134565,E=0.537253323062309,I=3.237105400043289,O=136.098149920559,W=41.78195141780046,T=22-FEB-2010:16:18:23,TTimeScale=TDB,EQUINOX=J2000,EPOCH=01-SEP-2010:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=-95.62288,A1=1.801267415285E-9,A2=2.259401232004E-10,A3=-8.444359153509E-10,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.		

Comments: Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSIRS2RAPID	11	2	false	true	NONE	4	8	1400.533	58201

Special Requirements	
	Between Dates 01-MAR-2023:00:00:00 and 02-APR-2023:00:00:00 Sequence Observations 1, 2, Non-interruptible DEFAULT WINDOW: ANGULAR RATE 81P FROM JWST LESS THAN 0.03

Observation

Proposal 1897, Observation 2: NIRSPEC IFU Background Mon Feb 27 21:02:03 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Background Observation For: [NIRSPEC IFU (Obs 1)]

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(2)	81P-BACKGROUND	TYPE=COMET,Q=1.598035332134565,E=0.537253323062309,I=3.237105400043289 ,O=136.098149920559,W=41.78195141780046,T=22-FEB-2010:16:18:23,TTimeScale=TDB,EQUINOX=J2000,EPOCH=01-SEP-2010:00:00:00,EpochTimeScale=TDB,R0=2.808 ,DT=-95.62288 ,A1=1.801267415285E-9,A2=2.259401232004E-10,A3=-8.444359153509E-10 ,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142 ,AMRAT=0.	TYPE=POS_ANGLE,RAD=180,ANG=90,REF=SUN	

Comments: Extended=YES

Template

TA Method
NONE

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G395H/F290LP	NRSIRS2RAPID	11	2	false	true	NONE	4	8	1400.533	58201

Special Requirements	
	Between Dates 01-MAR-2023:00:00:00 and 02-APR-2023:00:00:00 Sequence Observations 1, 2, Non-interruptible DEFAULT WINDOW: ANGULAR RATE 81P-BACKGROUND FROM JWST LESS THAN 0.03

Observation

Proposal 1897, Observation 3: MIRI IFUs Mon Feb 27 21:02:03 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[MIRI IFU Backgrounds (Obs 4)]

Diagnostics

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	81P	TYPE=COMET,Q=1.598035332134565,E=0.537253323062309,I=3.237105400043289,O=136.098149920559,W=41.78195141780046,T=22-FEB-2010:16:18:23,TTimeScale=TDB,EQUINOX=J2000,EPOCH=01-SEP-2010:00:00:00,EpochTimeScale=TDB,R0=2.808,DT=-95.62288,A1=1.801267415285E-9,A2=2.259401232004E-10,A3=-8.444359153509E-10,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.		

Comments: Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray
	ALL	YES	FULL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		IMAGER	F1130W	FASTR1	15	1	1	Dither 1	4	4	166.502	58201
1	LONG(C)	MRSLONG		FASTR1	15	1	1	Dither 1	4	4	166.502	58201
1	LONG(C)	MRSSHORT		FASTR1	15	1	1	Dither 1	4	4	166.502	58201
2		IMAGER	F1000W	FASTR1	25	1	1	Dither 1	4	4	277.504	58201
2	MEDIUM(B)	MRSLONG		FASTR1	25	1	1	Dither 1	4	4	277.504	58201
2	MEDIUM(B)	MRSSHORT		FASTR1	25	1	1	Dither 1	4	4	277.504	58201
3		IMAGER	F770W	FASTR1	60	1	1	Dither 1	4	4	666.01	58201
3	SHORT(A)	MRSLONG		FASTR1	60	1	1	Dither 1	4	4	666.01	58201
3	SHORT(A)	MRSSHORT		FASTR1	60	1	1	Dither 1	4	4	666.01	58201

Special Requirements	
	Between Dates 01-MAR-2023:00:00:00 and 02-APR-2023:00:00:00 Sequence Observations 3, 4, Non-interruptible DEFAULT WINDOW: ANGULAR RATE 81P FROM JWST LESS THAN 0.03

Observation

Proposal 1897, Observation 4: MIRI IFU Backgrounds Mon Feb 27 21:02:03 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [MIRI IFUs (Obs 3)]

Diagnostics

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(2)	81P-BACKGROUND	TYPE=COMET,Q=1.598035332134565,E=0.537253323062309,I=3.237105400043289 ,O=136.098149920559,W=41.78195141780046,T=22-FEB-2010:16:18:23,TTimeScale=TDB,EQUINOX=J2000,EPOCH=01-SEP-2010:00:00:00,EpochTimeScale=TDB,R0=2.808 ,DT=-95.62288 ,A1=1.801267415285E-9,A2=2.259401232004E-10,A3=-8.444359153509E-10 ,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142 ,AMRAT=0.	TYPE=POS_ANGLE,RAD=180,ANG=90,REF=SUN	

Comments: Extended=YES

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray
	ALL	YES	FULL

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1		IMAGER	F1130W	FASTR1	15	1	1	Dither 1	4	4	166.502	58201
1	LONG(C)	MRSLONG		FASTR1	15	1	1	Dither 1	4	4	166.502	58201
1	LONG(C)	MRSSHORT		FASTR1	15	1	1	Dither 1	4	4	166.502	58201
2		IMAGER	F1000W	FASTR1	25	1	1	Dither 1	4	4	277.504	58201
2	MEDIUM(B)	MRSLONG		FASTR1	25	1	1	Dither 1	4	4	277.504	58201
2	MEDIUM(B)	MRSSHORT		FASTR1	25	1	1	Dither 1	4	4	277.504	58201
3		IMAGER	F770W	FASTR1	60	1	1	Dither 1	4	4	666.01	58201
3	SHORT(A)	MRSLONG		FASTR1	60	1	1	Dither 1	4	4	666.01	58201
3	SHORT(A)	MRSSHORT		FASTR1	60	1	1	Dither 1	4	4	666.01	58201

Special Requirements	
	Between Dates 01-MAR-2023:00:00:00 and 02-APR-2023:00:00:00 Sequence Observations 3, 4, Non-interruptible DEFAULT WINDOW: ANGULAR RATE 81P-BACKGROUND FROM JWST LESS THAN 0.03